

0099082

DOE/RL-2011-77
Revision 0

Response Action Report for 200-MG-1 Operable Unit Waste Site 600-282

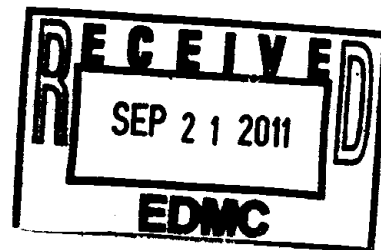
Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management



U.S. DEPARTMENT OF
ENERGY

Richland Operations
Office

P.O. Box 550
Richland, Washington 99352



Approved for Public Release;
Further Dissemination Unlimited

Attached to: 0099082

Response Action Report for 200-MG-1 Operable Unit Waste Site 600-282

Date Published
August 2011

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management



U.S. DEPARTMENT OF
ENERGY

Richland Operations
Office

P.O. Box 550
Richland, Washington 99352

[Signature]
Release Approval

08/10/2011
Date

Approved for Public Release;
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

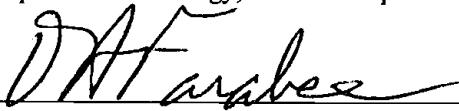
This report has been reproduced from the best available copy.

Printed in the United States of America

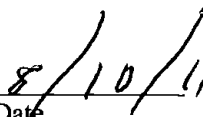
Approval Page

Title: *Response Action Report for 200-MG-1 Operable Unit Waste Site 600-282*

O. A. Farabee
U.S. Department of Energy, Richland Operations Office



Signature



Date

Executive Summary

This response action report documents the successful completion of the removal action conducted at the 600-282 waste site, also known as Wood and Coal Debris Piles. The alternative, proposed in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*¹ (EE/CA), and selected in DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit*² (Action Memorandum) via TPA-CN-350, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*³, was confirmatory sampling/no further action (CS/NFA).

The 600-282 waste site was investigated in November 2010 through field observations and sampling to determine the nature and extent of contaminants of potential concern (COPCs) present in the waste site soils as part of the selected removal action alternative of CS/NFA prescribed in the Action Memorandum (DOE/RL-2009-86). This investigation was performed in accordance with DOE/RL-2009-60, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*,⁴ and DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*⁵ (RAWP). Through the investigation summarized in this report, it was found that analytical results from the confirmatory sampling evolution demonstrated that soil conditions at the waste site did not meet removal action levels (RALs). Therefore, in accordance with the methodology prescribed in the Action Memorandum, the alternative was changed to removal, treatment, and disposal (RTD). Verification sampling conducted

¹ DOE/RL-2008-44, 2009, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www2.hanford.gov/arpir/?content=findpage&AKey=0096350>.

² DOE/RL-2009-86, 2010, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www2.hanford.gov/arpir/?content=findpage&AKey=0084449>.

³ TPA-CN-350, 2010, *Tri Party Agreement Change Notice Form: DOE/RL 2009 86, Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200 MG 1 Operable Unit*, Rev. 0, dated October 10, U.S. Department of Energy, Richland Operations Office, and Washington State Department of Ecology, Richland, Washington. Available at: <http://www5.hanford.gov/arpir/?content=findpage&AKey=1010270164>.

⁴ DOE/RL-2009-60, 2011, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: [http://www5.hanford.gov/pdw/fds/AR/FSD0001/FSD0064/0084054/11-AMCP-0080 - Letter \[1102030315\] - 1.pdf](http://www5.hanford.gov/pdw/fds/AR/FSD0001/FSD0064/0084054/11-AMCP-0080 - Letter [1102030315] - 1.pdf).

⁵ DOE/RL-2009-53, 2010, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www2.hanford.gov/arpir/?content=findpage&AKey=1010180132>.

after RTD activities confirmed that the waste site achieved compliance with RALs and, therefore, met the established removal action objectives without further removal action.

The results show that the residual soil concentrations of COPCs support reasonably anticipated future land use described in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86). These results also support reclassification to “interim closed out” status in accordance with the process described in RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, “Maintenance of the Waste Information Data System (WIDS).”⁶ No institutional controls are required because there is no deep vadose zone contamination associated with the 600-282 waste site.

This waste site and the data obtained from the subject sampling evolutions will be included in the risk assessment and the remedial investigation/feasibility study for final remedial decisions for the Outer Area.

⁶ RL-TPA-90-0001, 2007, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, “Maintenance of the Waste Information Data System (WIDS),” Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www.hanford.gov/hanford/files/TPA-MP14.pdf>.

Contents

1	Introduction	1-1
1.1	Site Description	1-1
1.1.1	Hanford General Site Information	1-2
1.1.2	200-MG-1 OU	1-2
1.2	Regulatory and Enforcement History	1-2
1.3	Environmental Setting	1-5
2	Waste Site Background	2-1
2.1	600-282 Site Background	2-1
2.2	Description of the Selected Alternative	2-2
2.2.1	Removal Action Objectives	2-3
2.2.2	Exposure and Land-Use Assumptions	2-6
2.2.3	Design Summary	2-7
2.3	Decision Document Amendments, Significant Differences, or Waivers	2-7
3	Response Activity Summary	3-1
3.1	Summary of Activities	3-1
3.1.1	Waste Site 600-282 Initial Sampling	3-1
3.1.2	Waste Site Excavation	3-3
3.1.3	Waste Site 600-282 Verification Sampling	3-4
3.1.4	Backfill and Revegetation	3-4
3.1.5	Statement of Protectiveness	3-4
4	Chronology of Events	4-1
5	Performance Standards and Construction Quality Control	5-1
5.1	Attainment of Performance Standards	5-1
5.1.1	Performance Standard Documentation	5-2
5.1.2	Response Action Objectives Verification	5-2
5.1.3	Contaminant Identification	5-2
5.2	Construction Quality Assurance/Quality Control	5-5
5.3	Cleanup Verification Quality Assurance/Quality Control	5-5
5.4	Regulatory Oversight	5-6
6	Final Inspection and Certifications	6-1
7	Operations and Maintenance Activities	7-1
7.1	Remedy Related Operations and Maintenance or Monitoring	7-1
7.2	Institutional Controls	7-1
7.3	Five-Year Reviews	7-1
8	Summary of Project Costs	8-1

9	Waste Site Reclassification	9-1
10	Observations and Lessons Learned	10-1
11	Contact Information	11-1
12	References	12-1

Appendix

A	Sampling Results for the 600-282 Waste Site	A-i
----------	--	------------

Figures

Figure 1-1. Location of the Hanford Site in Washington State.....	1-3
Figure 1-2. 200-MG-1 OU and the 600-282 Waste Site.....	1-4
Figure 2-1. 600-282 Waste Site Boundary and Operational Areas.....	2-1
Figure 3-1. Initial Sampling Locations at the 600-282 Waste Site	3-2
Figure 3-2. Verification Sampling Locations at the 600-282 Waste Site	3-5

Tables

Table 2-1. Nonradiological Removal Action Levels	2-4
Table 3-1. Concentrations of Contaminants of Potential Concern Exceeding Removal Action Levels.....	3-3
Table 4-1. Removal Action Chronology.....	4-1
Table 5-1. Summary of Attainment of Cleanup Objectives.....	5-2
Table 5-2. Comparison of Verification Sample Results Against Removal Action Levels for Nonradiological Contaminants of Potential Concern	5-3
Table 8-1. Cost Summary	8-1
Table A-1 Analytical Results of Sampling for Nonradiological Contaminants Initiating RTD	A-2
Table A-2. Analytical Results of In Process Sampling for Nonradiological Contaminants	A-5
Table A-3. Verification Sampling Results for Nonradiological Contaminants of Potential Concern	A-9

Terms

bgs	below ground surface
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
COPC	contaminant of potential concern
CS/NFA	confirmatory sampling/no further action
DOE	U.S. Department of Energy
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EE/CA	<i>Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites</i>
EPA	U.S. Environmental Protection Agency
HEIS	Hanford Environmental Information System
N/A	not applicable
NA	not available
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RAL	removal action level
RAO	removal action objective
RAWP	<i>Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit</i>
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RTD	removal, treatment, and disposal
SAP	<i>Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites</i>

TPH	total petroleum hydrocarbon
Tri-Party Agreement	<i>Hanford Federal Facility Agreement and Consent Order</i>
WIDS	Waste Identification Data System
ZPC	zone of potential contamination

1 Introduction

This report documents the successful completion of a non-time-critical removal action conducted at the 600-282 waste site. The removal action alternative of confirmatory sampling/no further action (CS/NFA) was selected for this waste site, as proposed in DOE/RL-2008-44, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites* (EE/CA), and authorized by DOE/RL-2009-86, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit* (Action Memorandum) via TPA-CN-350, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit, Rev. 0*. Sampling results from the confirmatory sampling evolution demonstrated that the waste site did not achieve compliance with the removal action levels (RALs). Using the methodology prescribed in the Action Memorandum, based on the analytical results, the alternative was changed to removal, treatment, and disposal (RTD). This report provides the basis for the successful completion of the RTD action performed at the 600-282 waste site. This documentation has been prepared based on U.S. Environmental Protection Agency (EPA) guidance provided in EPA/540/R-98/016, *Close Out Procedures For National Priorities List Sites*.

This report provides a summary of the actions taken and resulting data to support a determination that, through performance of the RTD alternative, conditions remaining at the 600-282 waste site have achieved the established RALs and have met the removal action objectives (RAOs) provided in the Action Memorandum (DOE/RL-2009-86). The documentation process is consistent with the U.S. Department of Energy (DOE) *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) Remedial Action Site Closure Guidance.

Statutory authority for the action taken is in accordance with CERCLA (as amended by the *Superfund Amendments and Reauthorization Act of 1986*), Executive Order 12580, *Superfund Implementation*, the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989), also known as the Tri-Party Agreement, and 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan."

In April 2011, the non-time-critical removal action for the 600-282 waste site was completed in accordance with DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit* (RAWP). This report provides the following information relative to the completion of the subject removal action:

- Background, historical information, regulatory enforcement history, and environmental setting pertinent to this removal action
- Descriptions of the selected alternative, RAOs, and exposure and land-use assumptions provided in the related regulatory documents
- A summary of the completed actions, the resulting data collected in support of completion of that removal action, a comparison of that data against objectives, and demonstration that RAOs have been met

1.1 Site Description

General information on the Hanford Site and the 200-MG-1 Operable Unit (OU) provides a background of and the development of the removal action for the 600-282 waste site and is described in the subsections that follow.

1.1.1 Hanford General Site Information

The Hanford Site, which is part of the DOE nuclear weapons complex, occupies approximately 1,517 km² (586 mi²) along the Columbia River in Benton County, northwest of the City of Richland in the Lower Columbia Basin in southeastern Washington State (Figure 1-1). From the early 1940s to approximately 1989, the Hanford Site mission included building the world's first large scale plutonium production facility and, until the 1980s, the Site was used to produce plutonium for nuclear weapons. Other activities included nuclear research, development, and nuclear materials production. These activities created a wide variety of chemical and radioactive wastes that were released into the environment. The Hanford Site mission is now focused on the cleanup of those wastes and ultimate closure of the Hanford Site.

1.1.2 200-MG-1 OU

The Washington State Department of Ecology (Ecology), DOE, and EPA created the 200-MG-1 OU through the Tri-Party Agreement Milestone M-015-06-02 and Tri-Party Agreement Change Request C-06-02 (Ecology et al., 1989). The 200-MG-1 OU is made up of waste sites in the 200 East and 200 West Areas, and the 600 Area of the Hanford Site. The 600 Area encompasses those areas south of the Columbia River that are not part of another designated area (i.e., 300 Area, 200 East Area, and 100-K) and are not specifically identified (Figure 1-1). The 200-MG-1 OU waste sites consist of French drains, trenches, cribs, ditches, retention basins with shallow contamination (generally less than 4.6 m [15 ft] deep), and where chemical and radioactive contaminants were released during material transfers (i.e., unplanned release sites). Additionally, some 200-MG-1 OU sites were produced by airborne dissemination of radioactive particles, or biodegradation and dispersion of plant or animal matter. For those sites containing radionuclides, the radionuclide inventory for this conceptual model group does not include transuranic isotopes greater than or equal to 100 nCi/g.

All of the waste sites contained in the 200-MG-1 OU are located within the Central Plateau, as described in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86). The 600-282 waste site, also known as Wood and Coal Debris Piles, is located in the 600 Area, just north of the 200 East Area (Figure 1-2).

1.2 Regulatory and Enforcement History

As discussed in Chapter 1, statutory authority for this removal action is taken in accordance with CERCLA. Further governing requirements for compliance with CERCLA and the *Resource Conservation and Recovery Act of 1976* activities at the Hanford Site are in accordance with the Tri-Party Agreement. The Hanford Site was proposed for inclusion in 53 FR 23988, "National Priorities List for Uncontrolled Hazardous Waste Sites – Update 7," hereafter referred to as the National Priorities List (NPL), and was placed on the NPL on November 3, 1989 (54 FR 41015, "National Priorities List for Uncontrolled Hazardous Waste Sites – Final Rule 10/04/89") by EPA. EPA placed the four aggregate areas (i.e., the 100, 200, 300, and 1100 Areas) on the NPL. The 200 Area NPL site consists of the 200 West and 200 East Areas, which contain waste management facilities and inactive irradiated fuel-reprocessing facilities. The Site also includes the 200 North Area, formerly used for interim storage and staging of irradiated fuel, and the waste sites assigned to the 200-MG-1 OU.

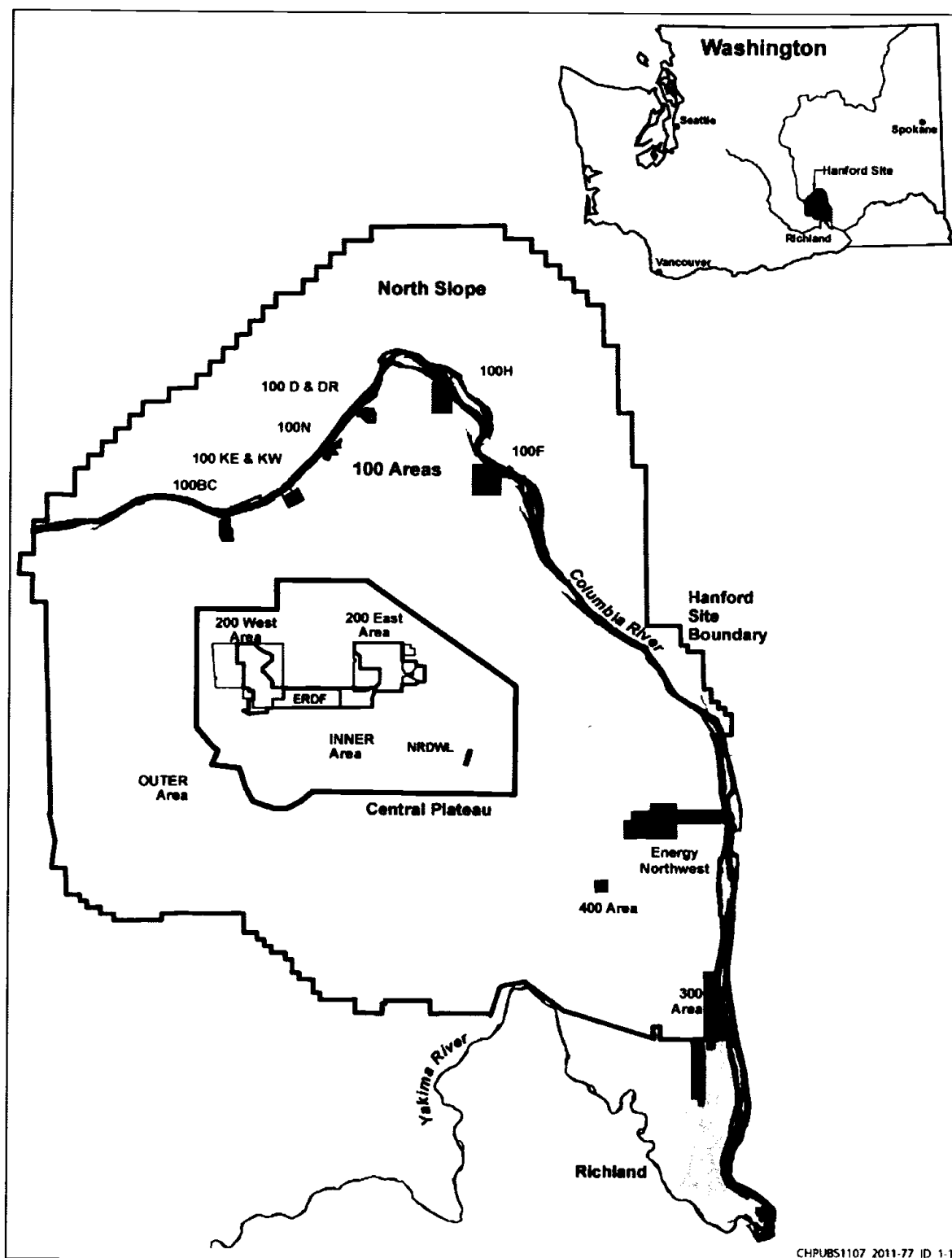


Figure 1-1. Location of the Hanford Site in Washington State



1.3 Environmental Setting

The Hanford Site is located within the semiarid Pasco Basin in the northern portion of the Columbia Plateau. Normal annual precipitation is 17.7 cm (7 in.). According to PNL-10285, *Estimated Recharge Rates at the Hanford Site*, there is an estimated 2.6 to 17.3 mm (0.1 to 0.7 in.) per year of recharge in the 100 Area. Bedrock beneath the Site is basalt of the Columbia River Basalt Group.

The Ringold Formation and the Hanford formation cover the basalt throughout the Central Plateau. Poorly consolidated, river-deposited, well-drained sands, gravels, cobbles, and boulders dominate these units. The Ringold Formation is an interstratified sequence of unconsolidated clay, silt, sand, and gravel-to-cobble sediment deposited by the ancestral Columbia River. The Hanford formation consists of uncemented gravels, sands, and silts deposited by Pleistocene cataclysmic floodwaters. Groundwater from the Hanford Site discharges to the Columbia River, the dominant surface water body of the Hanford Site. The direction of groundwater flow beneath the Central Plateau is toward the east northeast. The uses of the Columbia River include the production of hydroelectric power, irrigation, drinking water, recreation, and natural resources.

The average depth from ground surface to groundwater beneath the 200 Area ranges from 50 m (164 ft) to greater than 100 m (328 ft). Additional details on the geology and hydrogeology underlying the 200 Area and the 200-MG-1 OU are not provided in the base response action documents because the 200-MG-1 OU was created for shallow zone (less than 4.6 m [15 ft] in depth) waste sites, which are assumed not to be a threat to groundwater quality. This assumption is based on historical and process knowledge regarding volumes of liquids discharged, lack of mobility of contaminants, and shallow depth of the discharge(s).

The nearest natural surface water body to the 600-282 waste site is West Lake, located approximately 0.56 km (0.34 mi) east. The potential for natural groundwater recharge within the 200 Area is limited to precipitation infiltration. Estimates of recharge from precipitation at the Hanford Site range from 0 to 10 cm (0 to 4 in.) per year.

2 Waste Site Background

This chapter provides a description of the 600-282 waste site and information on process and background, describes the selected alternative, and delineates the RAOs and cleanup standards applicable to this removal action as prescribed in the Action Memorandum (DOE/RL-2009-86).

2.1 600-282 Site Background

The 600-282 waste site is a debris dumpsite located in the 600 Area. The waste site is north of the 200 East Area perimeter, west of Gable Mountain and West Lake (Figure 2-1). The site is flat although, in numerous areas, the surface is obscured by scattered debris piles. Vegetation cover is typical for the region, dominated by grasses and sagebrush.

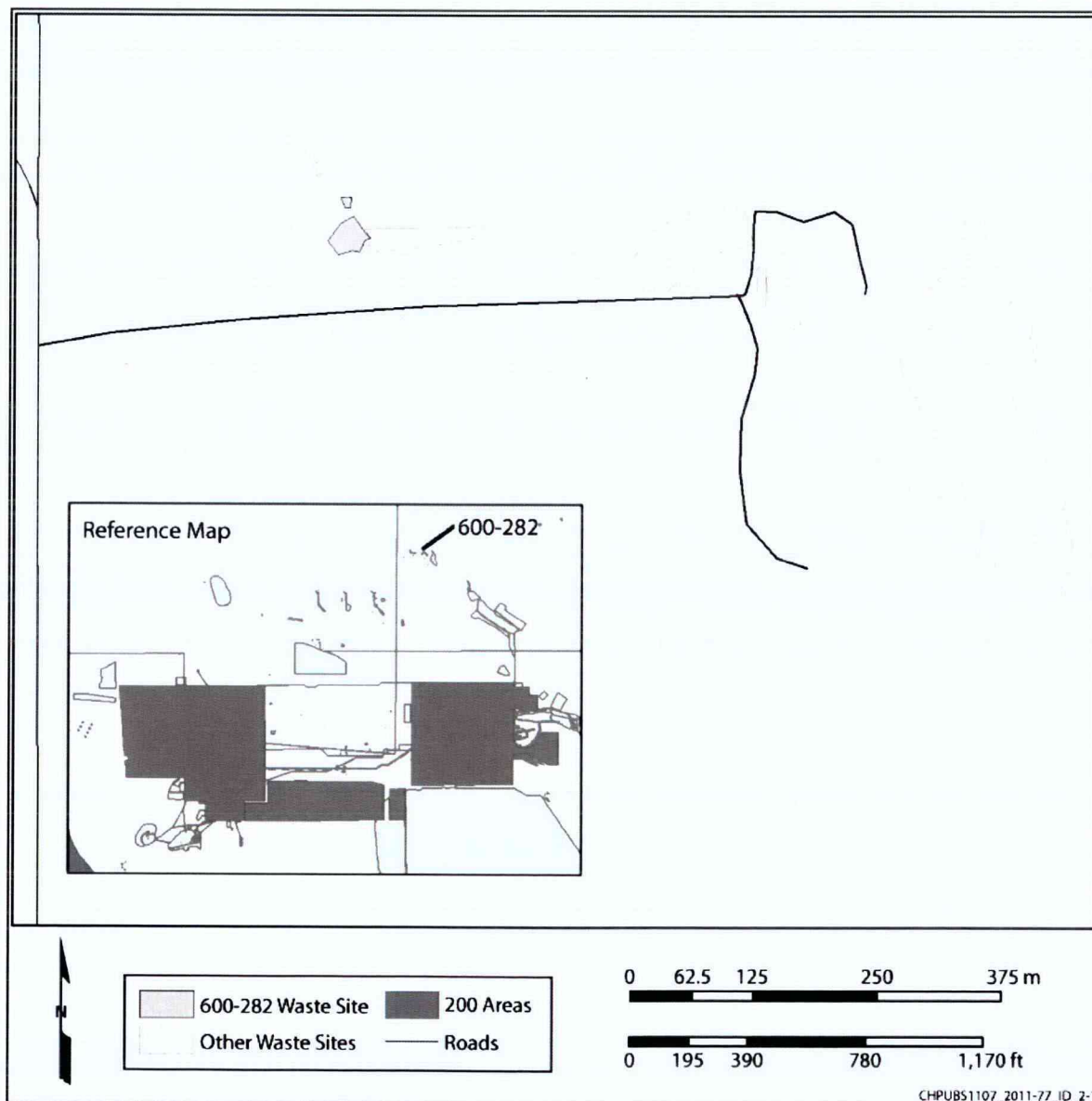


Figure 2-1. 600-282 Waste Site Boundary and Operational Areas

The waste site was identified and entered into the Waste Information Data System (WIDS) in October 2004. The original waste site area, as provided by WIDS, is approximately 0.26 acre in size (1,048 m² [11,287 ft²]). Observations made during a visual inspection performed in October 2004 included a pile of coal in the northern portion of the waste site. The southern portion of the 600-282 waste site contains an area of debris that appears to have been a structure, an earthen ramp, small coal pile, the westernmost portion of a drainage ditch, and what appeared to be a square well supplied by underground piping. A surface veneer of coal ash was strewn in the area between the north and south unit. The debris is generally concentrated in several piles in the southern unit as well as sparsely scattered over areas adjacent to the waste site. The debris generally consists of lumber, metal debris, and cans. WIDS indicates that radiological surveys performed in the area did not identify radiological contamination above background.

The release mechanism for this waste site is miscellaneous dumping and abandonment of debris not clearly associated with specific projects or facilities, and the current form of all waste materials is solid. No references could be found to substantiate liquid waste materials being dumped or discarded at this site related to the drainage ditches. No evidence exists (historical or present) that radiological processes involving a sustained release of materials are associated with this waste site.

2.2 Description of the Selected Alternative

As stated in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86), the selected alternative for the subject waste site was CS/NFA. This alternative was selected because, due to historical activity and process knowledge, contaminants of potential concern (COPCs) were not expected to exceed the RALs. Initial sampling and analysis did not confirm that concentrations of COPCs in soil were less than or equal to the RALs without the need for further action; therefore, the alternative was changed to RTD in accordance with the Action Memorandum. Activities involved in the RTD action set forth in the RAWP (DOE/RL-2009-53) and DOE/RL-2009-60, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites* (SAP) include soil excavation and verification sampling to demonstrate that concentrations of COPCs in soil are less than or equal to established RALs, and that no additional removal action is required. The general removal action sampling design criteria are provided in this section followed by a summary of waste site history, specific sampling design and methodology, and analytical results for the 600-282 waste site.

The following key features relevant to the 600-282 waste site were considered during the development of the sample design:

- Direct visual inspection of the waste site surface was performed, using available site information as a guide for visual cues such as staining, discoloration, absence of vegetation, presence of debris, and other anomalies.
- Radiological field screening was performed at the surface of the waste site to provide an indication of the presence of radiological COPCs.
- Focused sampling was performed per the methodology prescribed in the SAP (DOE/RL-2009-60). The use of focused samples based on process knowledge and visual indicators was considered appropriate for the initial sampling evolution. Random sampling in the impacted areas was considered appropriate for the verification sampling evolution.

Based on these key design features, soil samples were collected from the 600-282 waste site and analyzed for COPC concentrations. Evaluation of the initial sampling analytical results demonstrated that, for specific areas, concentrations of COPCs were greater than the RALs, resulting in the implementation of

the RTD alternative. Under this alternative, soils were removed from the impacted areas, and a verification sampling evolution was conducted, the results of which confirmed that remaining in situ soils were less than or equal to RALs for COPCs applicable to each impacted area. Table 5-2 provides the maximum concentrations for each COPC from the verification sampling analytical data. Tables A-1 through A-3 provide detailed summaries of all analytical data results for sampling conducted at the 600-282 waste site (Appendix A).

Personnel with current training and qualifications performed field radiological surveying of the samples and sampling locations during the sampling evolutions. Survey methods and practices were performed in accordance with established contractor methods and protocols. Of the radiological surveys performed for the 600-282 waste site, no radiological dose readings were greater than the measured background and no radiological contamination was found. The site was confirmed to be a nonradiological site, and the radiological COPCs were eliminated from the list of analytes to be included in laboratory analysis.

2.2.1 Removal Action Objectives

The removal action alternatives for the 200-MG-1 OU waste sites were evaluated based on their overall ability to protect human health and the environment and their effectiveness in maintaining both short term and long term protection. The selected alternative must meet the following RAOs established in the Action Memorandum (DOE/RL-2009-86):

- **RAO 1**—Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents to 4.6 m (15 ft) below ground surface (bgs) at concentrations above the appropriate RALs.
- **RAO 2**—Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.
- **RAO 3**—Control the sources of groundwater contamination to minimize impacts to groundwater resources, protect the Columbia River from adverse impacts, and reduce the degree of groundwater cleanup that may be required under future action.
- **RAO 4**—Prevent adverse impacts to cultural resources and threatened or endangered species, and minimize wildlife habitat disruption.

The RALs for the waste sites identified in the Action Memorandum (DOE/RL-2009-86) are based on the RAOs noted above. These RALs are based on attainment of acceptable levels of human health, ecological risk, and protection of groundwater but are not lower than background levels or detection limits for waste sites. Attainment of RALs is intended to meet the first three RAOs and is expected to satisfy the remedial action objectives established in the final record of decision (ROD). The fourth RAO is met through cultural and ecological reviews performed before starting removal action activities. Table 2-1 lists the nonradiological RALs applicable to the 200-MG-1 OU. The attainment of RALs and RAOs is provided in Chapter 5 of this report.

Table 2-1. Nonradiological Removal Action Levels

Contaminant of Concern	Background Concentration ^a (mg/kg)	Direct Exposure ^b (mg/kg)	Groundwater Protection ^c (mg/kg)	Required Detection Limit (mg/kg)	Removal Action Levels (mg/kg)	Ecological Risk Screening Values (mg/kg)
Antimony	5	32	5.4	0.6	5.4	5
Arsenic	6.5	6.5 ^d	6.5 ^d	1.0	6.5 ^d	7
Barium	132	16,000	1,650	2	1,650	102
Beryllium	1.51	160	63.2	0.5	63.2	10
Boron	N/A	16,000	210	2	210	0.5
Cadmium	0.81	80	0.81 ^d	0.5	0.81 ^d	4
Chromium Total	18.5	120,000	2,000	1	2,000	42
Chromium (VI)	N/A	240	-- ^e	0.5	-- ^e	N/A
Cobalt	15.7	24	15.7 ^d	2	15.7 ^d	20
Copper	22.0	3,200	284	1	284	50
Lead	10.2	250	3,000	5.0	250	50
Lithium	33.5	160	192	2.5	160	35
Manganese	512	3,760	512 ^d	5	512 ^d	1,100
Mercury	0.33	24	2.09	0.2	2.09	0.1
Nickel	19.1	1,600	130	4	130	30
Selenium	0.78	400	5.2	1	5.2	0.3
Silver	0.73	400	13.6	0.2	13.6	2
Strontium	N/A	48,000	2,920	1	2,920	N/A
Thallium	N/A	5.6	1.59	1	1.59	1
Tin	N/A	48,000	48,000	10	48,000	50
Uranium (Soluble Salts)	3.21	240	3.21 ^d	1	3.21 ^d	5
Vanadium	85.1	560	2,240	2.5	560	2
Zinc	67.8	24,000	5,970	1	5,970	86
PCB Aroclor 1016	N/A	0.5	0.094	0.017	0.094	0.65
PCB Aroclor 1221	N/A	0.5	0.017 ^d	0.017	0.017 ^d	0.65
PCB Aroclor 1232	N/A	0.5	0.017 ^d	0.017	0.017 ^d	0.65
PCB Aroclor 1242	N/A	0.5	0.039	0.017	0.039	0.65
PCB Aroclor 1248	N/A	0.5	0.039	0.017	0.039	0.65
PCB Aroclor 1254	N/A	0.5	0.066	0.017	0.066	0.65

Table 2-1. Nonradiological Removal Action Levels

Contaminant of Concern	Background Concentration ^a (mg/kg)	Direct Exposure ^b (mg/kg)	Groundwater Protection ^c (mg/kg)	Required Detection Limit (mg/kg)	Removal Action Levels (mg/kg)	Ecological Risk Screening Values (mg/kg)
PCB Aroclor 1260	N/A	0.5	0.72	0.017	0.5	0.65
Acenaphthene	N/A	4,800	98	0.33	98	20
Acenaphthylene	N/A	4,800	98	0.33	98	N/A
Anthracene	N/A	24,000	2,270	0.33	2,270	N/A
Benzo(a)anthracene	N/A	1.37	0.86	0.33	0.86	N/A
Benzo(a)pyrene	N/A	0.137	0.233 ^f	0.33	0.33 ^d	12
Benzo(b)fluoranthene	N/A	1.37	2.95	0.33	1.37	N/A
Benzo(g,h,i)perylene	N/A	2,400	25,700	0.33	2,400	N/A
Benzo(k)fluoranthene	N/A	1.37	2.95 ^f	0.33	1.37	N/A
Chrysene	N/A	13.7	9.56	0.33	9.56	N/A
Dibenz(a,h)anthracene	N/A	1.37	4.29	0.33	1.37	N/A
Fluoranthene	N/A	3,200	631	0.33	631	N/A
Fluorene	N/A	3,200	101	0.33	101	30
Indeno(1,2,3-cd)pyrene	N/A	1.37	8.33	0.33	1.37	N/A
Naphthalene	N/A	1,600	4.46	0.33	4.46	N/A
Phenanthrene	N/A	24,000	1,140	0.33	1,140	N/A
Pyrene	N/A	2,400	655	0.33	655	N/A
Carbon Tetrachloride ^g	N/A	7.69	0.0031	0.005	0.005	N/A
Xylene ^h	N/A	16,000	14.6	0.01	14.6	N/A
Nitrate (as Nitrogen)	11.8	128,000	40	0.75	40	N/A
TPH-Diesel	N/A	2,000	2,000	5	2,000	200
TPH-Kerosene	N/A	2,000	2,000	5	2,000	200
Fluoride ⁱ	N/A	4,800	16	5	16	N/A
Asbestos	N/A	N/A ^j	N/A ^j	N/A ^j	1 % ^j	N/A

Table 2-1. Nonradiological Removal Action Levels

Contaminant of Concern	Background Concentration ^a (mg/kg)	Direct Exposure ^b (mg/kg)	Groundwater Protection ^c (mg/kg)	Required Detection Limit (mg/kg)	Removal Action Levels (mg/kg)	Ecological Risk Screening Values (mg/kg)
<p>a. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication No. 94-115, <i>Natural Background Soil Metals Concentrations in Washington State</i>. Hanford Site background values are available from nonradiological background data in DOE/RL-92-24, <i>Hanford Site Soil Background: Part 1, Soil Background for Nonradioactive Analytes</i>, Rev. 4, Table D9-2.</p> <p>b. Direct contact values were calculated based on WAC 173-340-740, "Model Toxics Control Act—Cleanup," "Unrestricted Land Use Soil Cleanup Standards," using Method B methodology and assumptions.</p> <p>c. The groundwater protection values were obtained using equations provided in WAC 173-340-747(4), "Deriving Soil Concentrations for Groundwater Protection," with the physical parameters obtained from http://www.ecy.wa.gov/.</p> <p>d. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits in accordance with WAC 173-340-700(6)(d), "Overview of Cleanup Standards," and WAC 173-340-707(2), "Analytical Considerations," respectively.</p> <p>e. Based on process knowledge, chromium (VI) is not expected to be present at 200-MG-1 OU waste sites. The following values are given to help guide cleanup:</p> <ul style="list-style-type: none"> • 0.2 mg/kg—calculated value using $K_d = 0$, based on PNNL-13895, <i>Hanford Contamination Distribution Coefficient Database and Users Guide</i>, and WAC 173-340-747, equation 747-1. • 2.1 mg/kg—based on DOE/RL-96-17, <i>Remedial Design Report/Remedial Action Work Plan for the 100 Area</i>. • 18.4 mg/kg—based on Ecology, 2007, Cleanup Levels and Risk Calculations (CLARC) database. <p>f. The soil concentrations for protection of groundwater values for benzo(a)pyrene and benzo(k)fluoranthene were incorrectly reported in DOE/RL-2009-48, <i>Action Memorandum for Non-Time-Critical Removal Action for 11 Waste Sites in 200-MG-1 Operable Unit</i>, and have been corrected.</p> <p>g. Carbon tetrachloride is applicable to the 11 waste sites authorized by DOE/RL-2009-48.</p> <p>h. Xylene is applicable only to the 200-W-3, 216-S-19, and 216-S-26.</p> <p>i. Fluoride is added as a contaminant of potential concern for select sites, such as 216-S-19 and 216-S-26, based on process history.</p> <p>j. The removal action level for asbestos in soil is 1 percent by weight (measured using polarized light microscopy). EPA has used this value for determining if response actions for asbestos should be undertaken (Cook, 2004, "Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups"). Further evaluation of removal actions for asbestos will be conducted as needed on a site-specific basis in the Outer Area RI/FS.</p>						

Ecological screening values, which are based on WAC 173-340-900 "Model Toxics Control Act—Cleanup," "Tables," Table 749-3, are used for screening purposes only and are not considered cleanup levels for this CERCLA removal action (described more fully in Chapter 5 of the Action Memorandum [DOE/RL-2009-86]). If analytical results exceed the ecological screening values, the results will be further evaluated during the final ecological risk assessment in accordance with the remedial investigation/feasibility study (RI/FS) for the Central Plateau in order to make the final cleanup decisions.

2.2.2 Exposure and Land-Use Assumptions

The 600-282 waste site is located within the Central Plateau, as discussed in more detail in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86) for the 200-MG-1 OU. Land use for the Central Plateau is designated for reasonably anticipated future land use recognized in the EE/CA and Action Memorandum (for the purposes of this interim action, RAOs were selected that would support unrestricted land use).

2.2.3 Design Summary

The CS/NFA action alternative was the selected alternative for the 600-282 waste site. Sampling and analysis indicated that concentrations of COPCs in the waste site soils were greater than the RALs. Based on those analytical results, and per the methodology prescribed in the Action Memorandum (DOE/RL-2009-86), the alternative progressed to RTD. Following removal of the impacted soil, verification sampling was conducted to confirm that remaining in situ soil was less than or equal to the RALs. The sampling objectives for the 600-282 waste site included visual inspection and collection of discrete soil samples from the waste site as described in Section 3.1 of this report. Key features of the site-specific sampling design for the 600-282 waste site included the following:

- Direct visual inspection of the waste site surface was performed, using available site information as a guide for visual cues such as staining, discoloration, absence of vegetation, presence of debris, and other anomalies.
- Radiological field screening was performed at the surface of the waste site to provide an indication of the presence of radiological COPCs.
- Focused sampling was performed per the methodology prescribed in the SAP (DOE/RL-2009-60). The use of focused samples based on process knowledge and visual indicators was considered appropriate for the initial sampling evolution. Random sampling in the impacted areas was considered appropriate for the verification sampling evolution.

2.3 Decision Document Amendments, Significant Differences, or Waivers

No amendments to the EE/CA (DOE/RL-2008-44) or Action Memorandum (DOE/RL-2009-86), or technical impracticability waivers were associated with this removal action. A Tri-Party Agreement change notice (TPA-CN-350) has been approved for the Action Memorandum to add sites, including the 600-282 waste site, to the scope of the removal action, as authorized by Section 1.5.2 of the EE/CA (DOE/RL-2008-44).

3 Response Activity Summary

As stated in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86), the selected alternative for the 600-282 waste site was CS/NFA. The results of the confirmatory sampling indicated COPC concentrations greater than the RALs in one of the sampled areas (further details are provided in the text below). Per the provisions of the Action Memorandum, the removal action activities progressed to implementation of the RTD alternative for those areas, and for debris removal at the waste site. Upon completion of RTD activities, verification sampling was conducted to demonstrate that COPC concentrations in soil at the 600-282 waste site were less than or equal to the RALs, thus demonstrating that the RAOs established for this interim action were met.

3.1 Summary of Activities

The removal action at the 600-282 waste site was conducted from August 2010 through April 2011 and included the collection of focused and random soil samples from locations within the boundaries of the waste site, as specified in Section 2.2, and per the methodologies prescribed in the SAP (DOE/RL-2009-60). The following key activities were pertinent to the removal action at the 600-282 waste site:

- Collection of focused soil samples based on historical and process knowledge, and visual indicators.
- Excavation of soil, under the RTD alternative, in zone of potential contamination (ZPC) 2 (Figure 3-1), and the additional removal of scattered debris from locations throughout the waste site, along with underlying soil.
- Collection of random samples from ZPC 2 for verification purposes, laboratory analysis of soil samples for COPCs, and evaluation of analytical results to demonstrate achievement of RALs.

3.1.1 Waste Site 600-282 Initial Sampling

A site evaluation was performed on August 4, 2010, prior to performance of the initial sampling evolution. This evaluation served to support job planning as well as completion of the visual inspection component of the sampling activities described in the SAP (DOE/RL-2009-60). Visual inspection confirmed the wood debris and coal piles identified in previous inspections and recorded in historical data. The wood debris and coal piles are dispersed unevenly across the site. Debris encountered during the site evaluation was observed within the original waste site area of approximately 1,048 m² (11,287 ft²). In several areas, visual indications of contamination were noted and included discoloration, staining, or disturbed vegetation existing at this location. Based on the visual indicators and observations made during the site evaluation, eight ZPCs were identified at the 600-282 waste site. Figure 3-1 presents the eight ZPCs established at the waste site.

For radiological field screening at the 600-282 waste site, surveys were performed in accordance with established contractor methods and protocols by personnel with current training and qualifications. No radiological postings were present at the waste site. Radiological surveys performed during removal action activities indicated no radiological readings greater than the measured background, and no radiological contamination was found.

Initial soil sampling was conducted in November 2010 at the eight ZPCs established during site evaluation. Focused samples were collected from each ZPC based on historical and process knowledge and visual indicators from the surface, which is generally defined as 0 to 0.3 m (0 to 1 ft) bgs. The samples were analyzed for the full suite of COPCs (metals, polynuclear aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], volatile organic analytes, anions, and total petroleum hydrocarbons).

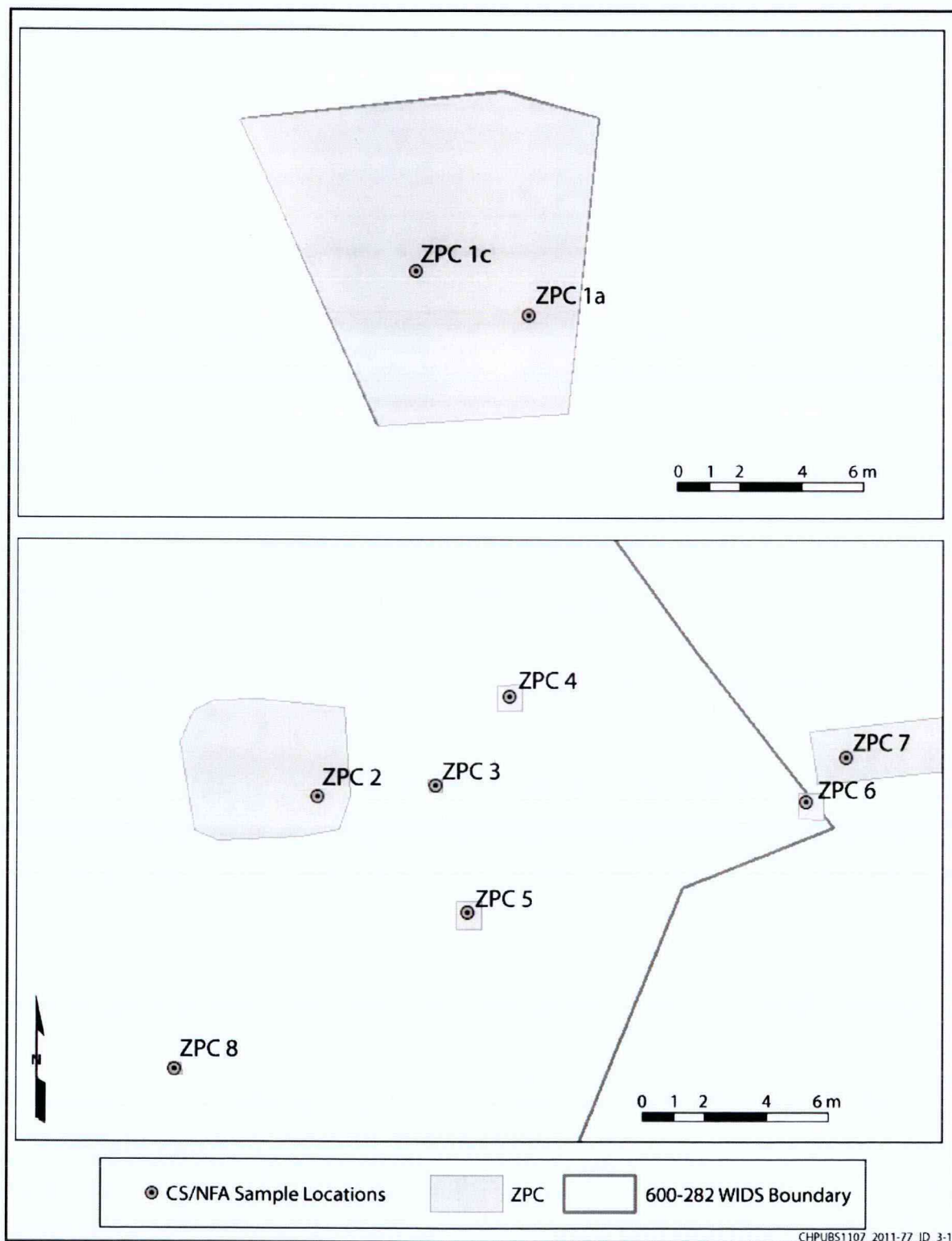


Figure 3-1. Initial Sampling Locations at the 600-282 Waste Site

Analytical results from the initial sampling evolution indicated concentrations of PAHs (benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) and metals (antimony, arsenic, cadmium, and uranium) exceeded RALs at ZPC 2, resulting in the implementation of the RTD alternative. Table 3-1 provides a summary of COPCs exceeding the RALs.

Visual indicators observed at ZPC 6 (which appeared to be a well with a rectangular wood frame) and ZPC 7 (an open drainage ditch) suggested a potential for contamination below the surface of the waste site in these areas; therefore, in process sampling at a depth of approximately 1.2 m (4 ft) bgs was conducted at ZPCs 6 and 7. Analytical results from initial and in process sampling in those areas confirmed that the ZPCs met the established RALs and corresponding RAOs and did not require RTD.

Table 3-1. Concentrations of Contaminants of Potential Concern Exceeding Removal Action Levels

Contaminant Of Potential Concern	Removal Action Level (mg/kg)	Initial Sampling
		B297F7/B297H9 ZPC 2 Surface (mg/kg)
Antimony	5.4	9.63
Arsenic	6.5	30.2
Cadmium	0.81	2.25
Uranium	3.21	3.62
Benzo(a)anthracene	0.86	10
Benzo(a)pyrene	0.33	6.1
Benzo(b)fluoranthene	1.37	13
Benzo(k)fluoranthene	1.37	11
Chrysene	9.56	13
Dibenz(a,h)anthracene	1.37	1.9
Indeno(1,2,3-cd)pyrene	1.37	8

Note: Surface is 0 to 0.3 m (0 to 1 ft) bgs.

3.1.2 Waste Site Excavation

The results of initial sampling indicated that concentrations of COPCs were greater than the RALs at ZPC 2. Removal of impacted soils in that area commenced on March 30, 2011, with the lateral extent of excavation at the ZPC determined utilizing visual indicators. In process samples collected at depths of 2.4 and 3.4 m (8 and 11 ft) bgs were used to refine the vertical extent of excavation to a total depth of approximately 2.4 m (8 ft) bgs. In addition to excavation at ZPC 2, scattered debris from locations throughout the 600-282 waste site was removed, along with underlying soil to a depth of approximately 0.1 m (0.3 ft) during RTD activities.

3.1.3 Waste Site 600-282 Verification Sampling

Analytical results from initial sampling indicated COPC concentrations were greater than the RALs at ZPC 2. This location became an area of excavation during implementation of the RTD alternative. The lateral and vertical extent of excavation in each area was identified utilizing visual indicators and in process sampling collected from ZPC 2 during RTD activities. Upon completion of RTD activities, a verification sampling design was developed for ZPC 2 utilizing Visual Sample Plan™ software to place samples randomly within the area of impact. The area of excavation at ZPC 2 was approximately 40 m² (430 ft²); therefore, two randomly selected samples were collected from the base of the excavation (Figure 3-2). Based on the results of initial sampling, the list of COPCs targeted during the verification sampling evolution was refined to include only PAHs and metals. Analytical results from initial sampling indicated a maximum concentration of manganese of 534 mg/kg. Manganese is not considered a COPC for the 600-282 waste site based on historical information and process knowledge. The reported maximum reported concentration is consistent with recorded background values at the Hanford Site and does not indicate a source of contamination.

3.1.4 Backfill and Revegetation

As described in Section 2.1 and Section 5.5.1 of the RAWP, backfill and/or contouring may take place upon concurrence by the signing parties that the RAOs have been attained. Finalization of a backfill concurrence form provided to the agency(ies) provided concurrence that the 600-282 waste site had achieved the established RAOs and thus backfill and/or contouring proceeded at the waste site. The backfill concurrence form was approved by the regulatory agency(ies) on May 25, 2011. Backfill of the 600-282 waste site was completed on May 26, 2011.

In accordance with the ecological compliance review conducted for the 600-282 waste site, this area does not meet the requirements of a Level III or Level IV designation as described in DOE/RL-96-32, *Hanford Site Biological Resources Management Plan*. Revegetation at the 600-282 waste site is not required. DOE may elect to revegetate the 600-282 waste site at a future date for aesthetic purposes.

3.1.5 Statement of Protectiveness

In accordance with the SAP (DOE/RL-2009-60), the soil at the 600-282 waste site has been sampled, analyzed, and evaluated. The results obtained through the implementation of the RTD alternative demonstrate that concentrations of COPCs in the soil at the 600-282 waste site are less than established RALs (discussed in further detail in Chapter 5). These results also indicate that residual concentrations will support reasonably anticipated future land use recognized in the EE/CA (DOE/RL-2008-44) and Action Memorandum (DOE/RL-2009-86), and demonstrate that residual concentrations of COPCs in soil throughout the site are unlikely to affect groundwater or the Columbia River. As summarized in Chapter 5, a review of the sampling results showed that the removal action at the 600-282 waste site has demonstrated achievement of the RAOs established in the Action Memorandum and identified in the RAWP (DOE/RL-2009-53).

™ PNNL-16939, *Visual Sample Plan, Version 5.0 User's Guide*. Visual Sample Plan is a registered trademark of Pacific Northwest National Laboratory, Richland, Washington.

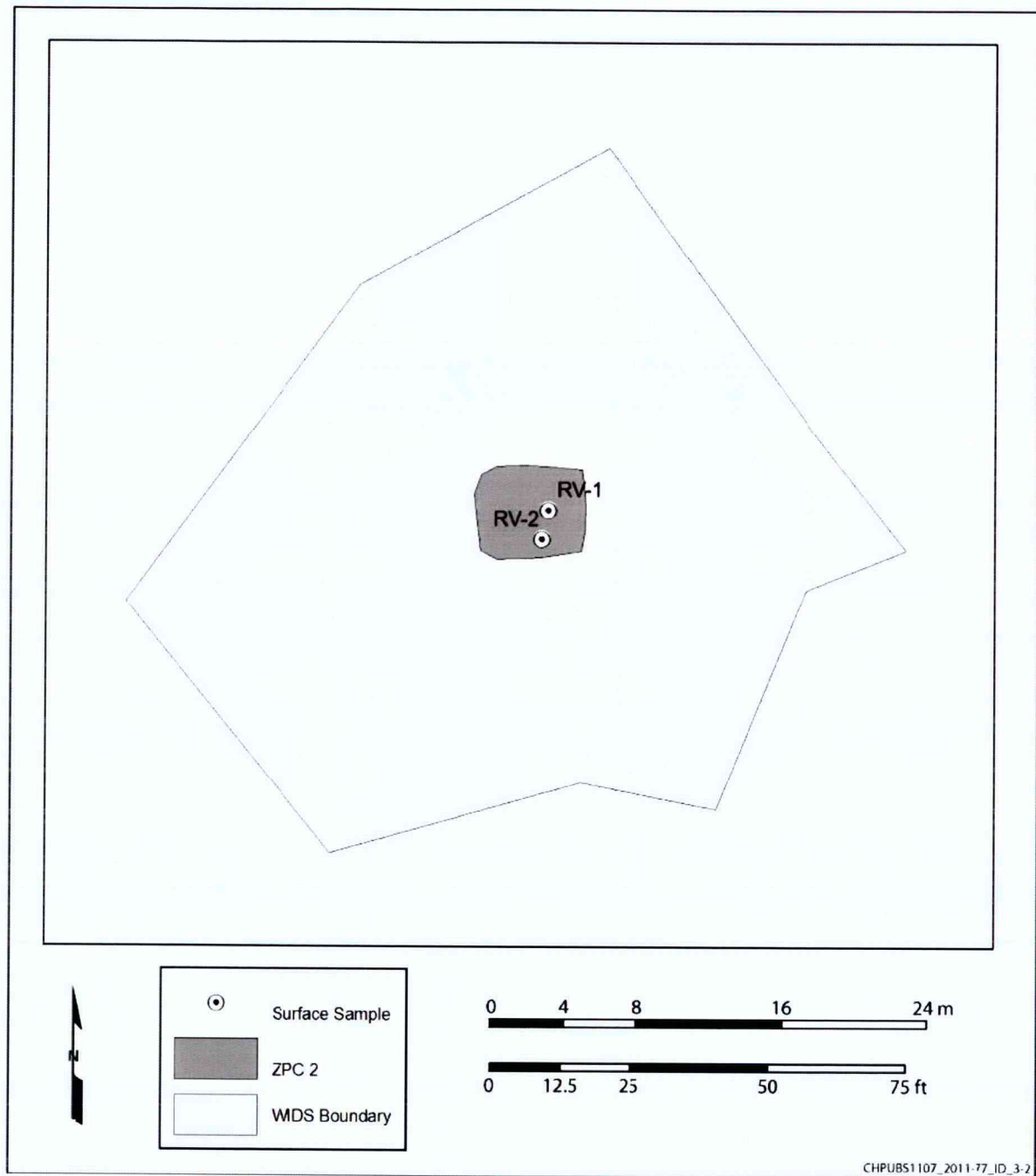


Figure 3-2. Verification Sampling Locations at the 600-282 Waste Site

4 Chronology of Events

Table 4-1 presents a chronology of major events associated with sampling the subject waste site. The chronology includes approval of the regulatory documents that form the basis of the removal action and key fieldwork activities associated with the removal action.

Table 4-1. Removal Action Chronology

Date	Event
June 5, 2009	DOE/RL-2008-44, Rev. 0, <i>Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites</i> , approved
April 15, 2010	DOE/RL-2009-86, Rev. 0, <i>Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in 200-MG-1 Operable Unit</i> , approved
April 21, 2010	Draft of DOE/RL-2009-53, Rev. 1, <i>Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit</i> , completed and routed for approval
May 20, 2010	Draft of DOE/RL-2009-60, Rev. 1, <i>Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites</i> , completed and routed for approval
August 4, 2010	Site evaluation of the 600-282 waste site completed
October 7, 2010	DOE/RL-2009-53, Rev. 1, approved
October 20, 2010	TPA-CN-350, <i>Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit</i> , Rev. 0, approved
November 10, 2010	Initial surface sampling of the 600-282 waste site completed
December 3, 2010	Laboratory analytical data evaluation completed
January 10, 2011	DOE/RL-2009-60, Rev. 1, approved
March 30, 2011	RTD of the 600-282 waste site commenced
April 5, 2011	In-process sampling and RTD of the 600-282 waste site completed
April 20, 2011	Laboratory analytical data evaluation completed
April 27, 2011	Verification sampling of the 600-282 waste site completed
May 25, 2011	Laboratory analytical data evaluation completed
May 25, 2011	Backfill Concurrence Form approved
May 26, 2011	Backfill of the 600-282 waste site completed

5 Performance Standards and Construction Quality Control

This chapter addresses the process for demonstrating achievement of performance standards, which include attaining RALs and RAOs and maintaining the required quality control (QC) during removal activities.

5.1 Attainment of Performance Standards

Soil sampling, laboratory analysis, and data evaluation conducted after RTD activities confirm that the 600-282 waste site meets the RAOs identified in the Action Memorandum (DOE/RL-2009-86), and residual levels of COPCs remaining in the soil are less than or equal to the RALs. As shown in Table 5-1, RAOs 1 and 2 are achieved by preventing unacceptable risk to human health and the environment through direct exposure to soils and debris by reducing the soil concentration of COPCs to less than or equal to the RALs. RAO 3 is achieved by preventing migration and/or leaching of radiological and nonradiological contamination to groundwater by reducing the soil concentration of COPCs to less than or equal to the RALs. RAO 4 is met through cultural and ecological evaluation, performed in June and July 2010, respectively, and by the implementation of considerations and recommendations during work activities. Demonstration that the soil concentration of COPCs is less than or equal to RALs (Table 5-2) meets RAOs 1, 2, and 3.

Per the methodology prescribed in the RAWP (DOE/RL-2009-53) and SAP (DOE/RL-2009-60), initial sampling of the 600-282 waste site consisted of visual inspection, radiological survey, and soil sampling performed between August and November 2010. Resulting data from the sampling evolution indicating concentrations of COPCs greater than the RALs initiated the removal of debris and impacted soils, performed in April 2011, followed by verification sampling performed in April 2011. The maximum verification analytical results, provided in Table 5-2, demonstrate that there are no chemical COPC concentrations greater than the RALs remaining in soil at the 600-282 waste site after RTD, thus meeting RAOs 1 and 3. Radiological survey performed during removal action activities demonstrated no radiological dose rates greater than background and no contamination found, thus meeting RAO 2. A complete summary of analytical data can be found in Tables A-1 through A-3 (Appendix A),

This waste site and the data obtained from the subject sampling evolutions will be included in the RI/FS for final remedial action of the Outer Area.

Table 5-1. Summary of Attainment of Cleanup Objectives

Removal Action Objective	Compliance Methods	Removal Action Objective Attained?
RAO 1: Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with nonradiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.	Achieved through verification soil sampling, performed upon completion of RTD activities, which demonstrated that all individual COPC concentrations are less than or equal to the RALs.	Yes
RAO 2: Prevent unacceptable risk to human health and ecological receptors from exposure to soils and/or debris contaminated with radiological constituents to 4.6 m (15 ft) bgs at concentrations above the appropriate RALs.	Achieved through the radiological survey of soils within the waste site, conducted during site evaluation and sampling evolutions, which resulted in no measured dose rates greater than background established for the waste site and no detectable radiological contamination. This demonstrates that all individual radiological COPC concentrations are less than or equal to the RALs.	Yes
RAO 3: Control the sources of groundwater contamination to minimize impacts to groundwater resources, protect the Columbia River from adverse impacts, and reduce the degree of groundwater cleanup that may be required under future actions.	Achieved through verification soil sampling, performed upon completion of RTD activities, which demonstrated that concentrations of COPCs in soil were less than established RALs.	Yes
RAO 4: Prevent adverse impacts to cultural resources and threatened or endangered species, and minimize wildlife habitat disruption.	Achieved through cultural and ecological evaluation and the implementation of considerations during removal activities to minimize wildlife habitat and cultural artifact disruption.	Yes

5.1.1 Performance Standard Documentation

This response action report addresses the individual 600-282 waste site and not an OU; therefore, this section is not applicable.

5.1.2 Response Action Objectives Verification

RAO performance standard attainment involves comparisons of soil analytical data to RALs. The RALs, identified in the Action Memorandum (DOE/RL-2009-86) and RAWP (DOE/RL-2009-53), are directly compared to the maximum results from the verification analytical data (Table 5-2). The full set of analytical results from all samples collected is provided in Appendix A.

5.1.3 Contaminant Identification

Table 5-2 provides a direct comparison of verification sample analytical results for each nonradiological COPC against the established RALs for the 600-282 waste site.

Table 5-2. Comparison of Verification Sample Results Against Removal Action Levels for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Background Concentration ^a (mg/kg)	Removal Action Level (mg/kg)	Maximum Concentration in Soil (mg/kg)	Does the Maximum Exceed Removal Action Levels?
Metals				
Antimony	5	5.4	0.938	No
Arsenic	6.5	6.5 ^b	3.57	No
Barium	132	1,650	444	No
Beryllium	1.51	63.2	0.47	No
Boron	N/A	210	14.1	No
Cadmium	0.81	0.81 ^b	0.619	No
Chromium Total	18.5	2,000	12.6	No
Chromium (VI)	N/A	N/A ^c	0.000348	No
Cobalt	15.7	15.7 ^b	11.8	No
Copper	22	284	18.7	No
Lead	10.2	250	40.9	No
Lithium	33.5	160	10.1	No
Nickel	19.1	130	11.4	No
Selenium	0.78	5.2	1.63	No
Silver	U	13.6	U	No
Strontium	N/A	2,920	135	No
Thallium	0.1	1.59	0.118	No
Tin	N/A	48,000	2.71	No
Uranium	3.21	3.21 ^b	1.54	No
Vanadium	85.1	560	94.1	No
Zinc	67.8	5970	437	No
Polynuclear Aromatic Hydrocarbons				
Acenaphthene	N/A	98	U	No
Acenaphthylene	N/A	98	U	No
Anthracene	N/A	2,270	U	No
Benzo(a)anthracene	N/A	0.86	0.46	No

Table 5-2. Comparison of Verification Sample Results Against Removal Action Levels for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Background Concentration ^a (mg/kg)	Removal Action Level (mg/kg)	Maximum Concentration in Soil (mg/kg)	Does the Maximum Exceed Removal Action Levels?
Benzo(a)pyrene	N/A	0.33 ^b	0.25	No
Benzo(b)fluoranthene	N/A	1.37	0.63	No
Benzo(k)fluoranthene	N/A	1.37	0.52	No
Benzo(g,h,i)perylene	N/A	2,400	U	No
Chrysene	N/A	9.56	0.6	No
Dibenz(a,h)anthracene	N/A	1.37	U	No
Fluoranthene	N/A	631	0.35	No
Fluorene	N/A	101	U	No
Indeno(1,2,3-cd)pyrene	N/A	1.37	0.23	No
Naphthalene	N/A	4.46	0.22	No
Phenanthrene	N/A	1,140	0.42	No
Pyrene	N/A	655	0.26	No

a. If Hanford Site-specific background data are not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available from nonradiological background data in DOE/RL-92-24, Rev. 4, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Table D9-2.

b. Where cleanup levels are less than background or RDLs, cleanup levels default to background or RDLs in accordance with "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards" (WAC 173-340-700(6)(d)), and "Analytical Considerations" (WAC 173-340-707(2)), respectively.

c. Based on process knowledge, chromium (VI) is not expected to be present at 200-MG-1 OU waste sites. The following values are given to help guide cleanup:

- 0.2 mg/kg is the calculated value using $K_d = 0$, based on PNNL-13895, *Hanford Contamination Distribution Coefficient Database and Users Guide*, and WAC 173-340-747, "Deriving Soil Concentrations for Groundwater Protection," equation 747-1.
- 2.1 mg/kg is based on DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.
- 18.4 mg/kg is based on Ecology, 2007, Cleanup Levels and Risk Calculations (CLARC) database.

U = result is less than laboratory detection limit

5.2 Construction Quality Assurance/Quality Control

No construction-related aspects were implemented as part of the selected alternative for the 600-282 waste site; therefore, this section is not applicable.

5.3 Cleanup Verification Quality Assurance/Quality Control

A data quality assessment (DQA) review was performed to compare the sampling approach and analytical data with the sampling and data requirements specified by the SAP (DOE/RL-2009-60). This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use. The assessment review completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality process.

Level C data validation as defined in the contractor's validation procedures, which are based on EPA functional guidelines (Bleyler, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*; Bleyler, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*), was performed for the entire sampling and analysis data package for the verification samples collected for the 600-282 waste site. Level C validation is a review of the QC data and specifically requires verification of deliverables and requested versus reported analyses and qualification of the results based on analytical holding times, method blank results, matrix spike/matrix spike duplicates, surrogate recoveries, duplicates, and analytical method blanks. Specific data quality objectives for the waste site are found in the SAP (DOE/RL-2009-60).

All of the sampling and analysis data generated from the sampling at the 600-282 waste site are tracked through the Hanford Environmental Information System (HEIS). All of the sampling and analysis data for the 600-282 waste site were found to be useable for decision making purposes as provided in the following summary:

HEIS Identification Numbers. B297F5/B297H7, B297F6/B297H8, B297F7/B297H9, B297F8/B297J0, B297F9/B297J1, B297H0/B297J2, B297H1/B297J3, B297K1/B297K7, B297H2/B297J4, B297K2/B297K8, B297H3/B297J5, B297H5/B297J7, B297H6/B297J8, B297K3/B297K9, B2D793, and B2D795.

Blanks. Equipment blanks (B297L1, B297L3, and B2D798) and field transfer blanks (B297L4 and B297L5) were received intact to the laboratory and holding times were acceptable.

Field Duplicates. The duplicate (B297H4/B297J6 and B2D794) results were acceptable.

Data Completeness. Analytical reports submitted for validation and verified for completeness based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100 percent. The data have been determined to be useable for decision making purposes. The final results narrative supporting the sampling analysis activities and findings, and copies of chains of custody were transmitted in letter reports from the laboratory.

Field Screening. Relative to analytical data in sample media, physical data and/or field screening results are of lesser importance in making inferences of risk. Because of the secondary importance of such data, no validation for physical property data and/or field screening results was performed. However, field quality assurance (QA)/QC was reviewed to ensure that the data are useable. Field instrumentation, calibration, and QA checks were performed in accordance with the following:

- Calibration of radiological field instruments (such as Geiger-Müller and portable alpha meters) on the Hanford Site is performed under contract by Pacific Northwest National Laboratory, as specified in their program documentation.
- Daily calibration checks are performed and documented for each instrument used in support of waste site sampling and investigation. These checks are made on standard materials that are sufficiently like the matrix under consideration that direct comparison of data can be made. Daily calibration checks of radiological field instruments were performed by trained and qualified radiological control technicians in accordance with established program requirements.

The review and approval of completed field radiation surveys by the radiological controls organization represents the data validation and usability review for handheld field radiological measurements.

The DQA review for the 600-282 waste site found the analytical results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The data are of the correct type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected because of QA/QC deficiencies. All analytical data were found acceptable for decision making purposes. All of the sampling analytical data are stored in HEIS.

5.4 Regulatory Oversight

This document provides a summary of the removal action taken at the 600-282 waste site. It shows a comparison of the data collected to RALs authorized in approved regulatory documents and provides the basis to reclassify the waste site status (see Chapter 9). Though this report does not require approval by Ecology or EPA, concurrence of those agencies is necessary, under CERCLA Section 120 and the Tri-Party Agreement, for determinations concerning follow-on remedial actions. This report is therefore provided to the agency (or agencies) for review, in accordance with the approval process for waste site reclassification, as supporting documentation. Upon approval of the waste site reclassification, a copy of this report shall be maintained in the Administrative Record. No additional regulatory oversight was required for the sampling of the 600-282 waste site.

6 Final Inspection and Certifications

There were no final inspections or certifications required in the implementation of the selected alternative for the 600-282 waste site; therefore, this chapter is not applicable.

7 Operations and Maintenance Activities

This chapter discusses the operations and maintenance (O&M) for the 600-282 waste site.

7.1 Remedy Related Operations and Maintenance or Monitoring

There are no O&M activities or monitoring requirements for the 600-282 waste site; therefore, this section is not applicable.

7.2 Institutional Controls

Based on the analyses performed and presented in this report, there are no waste site-specific institutional controls required at the 600-282 waste site; therefore, this section is not applicable.

7.3 Five-Year Reviews

Five-year reviews are required by CERCLA for post-ROD remedial actions, which do not apply to the 600-282 waste site. This waste site and the data obtained from the subject sampling evolutions will be included in the risk assessment and RI/FS for final remedial action of the Outer Area.

8 Summary of Project Costs

For the purposes of reporting costs of removal action for the 600-282 waste site, costs are pro rated utilizing an activity/schedule-based methodology (Table 8-1). This method is not considered to be audit quality data. Actual costs for waste site cleanup will continue to be collected for each OU or closure area in accordance with the current cost tracking methodology. These costs will then be included, in accordance with CERCLA requirements, in the response action report for the final remedial action of the OU or closure area.

Table 8-1. Cost Summary

Cost Item	Actual Cost Fiscal Year 2010 (\$)	Actual Cost Fiscal Year 2011 (\$)	Actual Total Cost (\$)
Removal Action Capital (Construction) Costs	0	0	0
Removal Action Operating Costs	5,600.00	132,823.20	138,423.20
Total Removal Action Cost	5,600.00	132,823.20	138,423.20
Projected Yearly Operations and Maintenance Cost	0	0	0

9 Waste Site Reclassification

The waste site reclassification form for the 600-282 waste site is proposed and processed in accordance with the procedures and definitions described in RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)." Reclassification form 2011-074 for the 600-282 waste site proposes that the status of this waste site be changed to "interim closed out." Per RL-TPA-90-0001, "interim closed out" status indicates that a site meets the cleanup standards specified in the approved 200-MG-1 Action Memorandum (DOE/RL-2009-86) (i.e., the interim response action decision document). This site will be evaluated under the cleanup standards established for the final ROD for this area.

10 Observations and Lessons Learned

There were no observations or lessons learned applicable for inclusion in this report.

11 Contact Information

The DOE Contractor:

R.L. Cathel
Geographic Closure, Environmental, Waste, and Quality Assurance Director
CH2M HILL Plateau Remediation Company
P.O. Box 1600, MSIN R3-60
Richland, WA 99352
Telephone: 509-373-9171

The Project Manager for DOE:

F.M. Roddy
200-MG-1 Operable Unit Project Manager
Department of Energy, Richland Operations Office
P.O. Box 550, MSIN A5-11
Richland, WA 99352
Telephone: 509-372-0945

The Project Manager for the Lead Regulatory Agency:

L. Buelow
Environmental Scientist
U.S. Environmental Protection Agency
Hanford Project Office
309 Bradley Boulevard, Suite 115, MSIN B1-46
Richland, WA 99352
Telephone: 509-376-5466

12 References

- 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: <http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/xml/CFR-2010-title40-vol27-part300.xml>.
- 53 FR 23988, "National Priorities List for Uncontrolled Hazardous Waste Sites – Update 7," *Federal Register*, Vol. 53, No. 122, pp. 23988 – 23998, June 24, 1988. Available at: <http://www.epa.gov/superfund/sites/npl/p880624.htm#23988>.
- 54 FR 41015, "National Priorities List for Uncontrolled Hazardous Waste Sites – Final Rule 10/04/89," *Federal Register*, Vol. 54, No. 191, pp. 41015 – 41025, October 4, 1989. Available at: <http://www.epa.gov/superfund/sites/npl/f891004.htm#41015>.
- Bleyler, Ruth, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, Washington, D.C. Available at: <http://www2.hanford.gov/ARPIR/index.cfm?content=findpage&AKey=D196013784>.
- Bleyler, Ruth, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*, Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, Washington, D.C. Available at: <http://www2.hanford.gov/ARPIR/index.cfm?content=findpage&AKey=D196013785>.
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: <http://epw.senate.gov/cercla.pdf>.
- Cook, Michael B., 2004, "Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups" (memorandum to Superfund National Policy Managers, Regions 1-10), OSWER 9345.4-05, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., August 10. Available at: <http://www.epa.gov/region9/toxic/noa/eldorado/pdf/memo722b.pdf>.
- DOE Office of Health, Safety, and Security, 2004, *CERCLA Remedial Action Site Closure Guidance*. Available at: <http://homer.ornl.gov/nuclearsafety/env/guidance/cercla/siteclosure>.
- DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C. Available at:
<http://www5.hanford.gov/arpir/?content=findpage&AKey=D199158842>.
<http://www5.hanford.gov/arpir/?content=findpage&AKey=D199158843>.
<http://www5.hanford.gov/arpir/?content=findpage&AKey=D199158844>.
<http://www5.hanford.gov/arpir/?content=findpage&AKey=D199158845>.
<http://www5.hanford.gov/arpir/?content=findpage&AKey=D199158846>.
<http://www5.hanford.gov/arpir/?content=findpage&AKey=D199158847>.
- DOE/EIS-0222-SA-01, 2008, *Supplement Analysis: Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/files.cfm/SAwith_signed-RI.pdf.

- DOE/RL-92-24, 1993, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 1, 2 vols., U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
<http://www2.hanford.gov/arpir/?content=findpage&AKey=D196133548>.
- DOE/RL-92-24, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 4, 2 vols., U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
<http://www2.hanford.gov/arpir/?content=findpage&AKey=0096062>.
<http://www2.hanford.gov/arpir/?content=findpage&AKey=0096061>.
- DOE/RL-96-17, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
<http://www5.hanford.gov/arpir/?content=findpage&AKey=0095436>.
- DOE/RL-96-32, 2001, *Hanford Site Biological Resources Management Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
<http://www.pnl.gov/ecomon/docs/brmap/BRMaP.pdf>.
- DOE/RL-2008-44, 2009, *Engineering Evaluation/Cost Analysis for the 200-MG-1 Operable Unit Waste Sites*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www5.hanford.gov/arpir/?content=findpage&AKey=0096350>.
- DOE/RL-2009-53, 2010, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://www2.hanford.gov/arpir/?content=findpage&AKey=1010180132>.
- DOE/RL-2009-60, 2011, *Sampling and Analysis Plan for Selected 200-MG-1 Operable Unit Waste Sites*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: [http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0064/0084054/11-AMCP-0080_-_Letter_\[1102030315\]_-_1.pdf](http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0064/0084054/11-AMCP-0080_-_Letter_[1102030315]_-_1.pdf).
- DOE/RL-2009-86, 2010, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
<http://www5.hanford.gov/arpir/?content=findpage&AKey=0084449>.
- Ecology, 2007, *Cleanup Levels and Risk Calculations (CLARC) database*, Washington State Department of Ecology. Available at: <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
- Ecology Publication 94-115, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Toxics Cleanup Program, Washington State Department of Ecology, Olympia, Washington. Available at: <http://www.ecy.wa.gov/pubs/94115.pdf>.
- Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at:
<http://www.hanford.gov/?page=81>.

- Ecology, EPA, and DOE, 2006, *Hanford Federal Facility Agreement and Consent Order Changes to Central Plateau Waste Site and Groundwater Remediation Milestones (including Tentative Agreement on Negotiations, Introduction, Federal Facilities Agreement and Consent Order Change Control Form M-15-16-02, M-13-06-01, P-11-06-01, C-06-02, September 14,* Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Washington.
- EPA 540-R-98-016, 2000, *Close Out Procedures for National Priorities List Sites*, OSWER Directive 9320.2-09A-P, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Available at:
http://www.epa.gov/superfund/programs/npl_hrs/closeout/pdf/guidance.pdf.
- Lindsey, K.A., 1996, *The Miocene to Pliocene Ringold Formation and Associated Deposits of the Ancestral Columbia River System, South-Central Washington and North-Central Oregon*, Washington Department of Natural Resources, Washington Division of Geology and Earth Resources, Open File Report 96-8, Olympia, Washington. Available at:
http://www/dnr.wa.gov/Publications/ger_ofr96-8_ringold_formation.pdf.
- PNL-5506, 1986, *Hanford Site Water Table Changes 1950 through 1980: Data Observations and Evaluation*, Pacific Northwest Laboratory, Richland, Washington.
- Executive Order 12580, 1987, *Superfund Implementation*, Ronald W. Reagan, January 23. Available at:
<http://www.archives.gov/federal-register/codification/executive-order/12580.html>.
- PNL-10285, 1995, *Estimated Recharge Rates at the Hanford Site*, Pacific Northwest Laboratory, Richland, Washington. Available at:
<http://www.osti.gov/energycitations/servlets/purl/10122247-XORHkt/webviewable/10122247.pdf>.
- PNNL-13895, 2003, *Hanford Contaminant Distribution Coefficient Database and Users Guide*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington. Available at:
<http://www5.hanford.gov/arpir/?content=findpage&AKey=0911300341>.
- PNNL-16939, 2007, *Visual Sample Plan, Version 5.0 User's Guide*, Pacific Northwest National Laboratory, Richland, Washington. Available at:
www.pnl.gov/main/publications/external/technical_reports/PNNL-16939.pdf.
- Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. Available at:
<http://epw.senate.gov/rcra.pdf>.
- RL-TPA-90-0001, 2007, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
<http://www.hanford.gov/files.cfm/TPA-MP14.pdf>.
- Superfund Amendments and Reauthorization Act of 1986*, 42 USC 103, et seq. Available at:
<http://www.epa.gov/superfund/policy/sara.htm>.
- TPA-CN-350, 2010, *Tri-Party Agreement Change Notice Form: DOE/RL-2009-86 Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 0, dated October 20, U.S. Department of Energy, Richland Operations Office, and U.S. Environmental Protection Agency, Richland, Washington. Available at:
<http://www2.hanford.gov/arpir/?content=detail&AKey=1010270164>.

WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, Olympia, Washington. Available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340>.

340-700, "Overview of Cleanup Standards."

340-707, "Analytical Considerations."

340-740, "Unrestricted Land Use Soil Cleanup Standards."

340-747, "Deriving Soil Concentrations for Groundwater Protection."

340-900, "Tables."

Appendix A

Sampling Results for the 600-282 Waste Site

A1 Sampling Results for the 600-282 Waste Site

This appendix contains laboratory analytical results, provided in Tables A-1 through A-3, from the sampling conducted at the 600-282 waste site. The following information is provided in the table headings: Hanford Environmental Information System identification numbers, field sample identifier, and sample depth. Depths provided in the tables are below original grade. Surface samples are collected from 0 to 0.3 m (0 to 1 ft) below ground surface.

- Table A-1 provides analytical results for nonradiological contaminants from samples collected during the initial phase of sampling from zone of potential contamination (ZPC) 2, which did not meet the established removal action levels (RALs), therefore requiring removal, treatment, and disposal (RTD).
- Table A-2 includes analytical results from in process samples collected from ZPCs 2, 6, and 7. The analytical results from these in process samples were used to refine the vertical extent of excavation during RTD activities.
- Table A-3 includes verification sampling results for ZPC 2, as well as analytical data from the initial sampling evolution at the remaining ZPCs, which demonstrate that concentrations of contaminants of potential concern (COPCs) are less than RALs at the 600-282 waste site, thereby attesting to the achievement of corresponding RAOs.

Table A-1 Analytical Results of Sampling for Nonradiological Contaminants Initiating RTD

Contaminant	Removal Action Levels^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration^b (mg/kg)	B297F7 B297H9 ZPC2 Surface (mg/kg)
Metals					
Antimony	5.4	0.6	0.4	5	9.63
Arsenic	6.5 ^c	1	0.54	6.5	30.2
Barium	1,650	2	0.27	132	1,200
Beryllium	63.2	0.5	0.13	1.51	0.989
Boron	210	2	5.7	N/A	108
Cadmium	0.81 ^c	0.5	0.13	0.81	2.25
Chromium Total	2,000	1	0.67	18.5	19
Chromium (VI)	N/A	0.5	3.4	N/A	U
Cobalt	15.7 ^c	2	0.13	15.7	10.8
Copper	284	1	0.13	22	101
Lead	250	5	0.13	10.2	210
Lithium	160	2.5	0.56	33.5	11.1
Manganese	512 ^c	5	0.13	512	534 ^c
Mercury	2.09	0.2	0.067	0.33	0.0838
Nickel	130	4	0.27	19.1	27.4
Selenium	5.2	1	0.4	0.78	3.51
Silver	13.6	0.2	0.13	U	0.277
Strontium	2,920	1	0.13	N/A	340
Thallium	1.59	1	0.13	0.1	0.247
Tin	48,000	10	0.13	N/A	4.7
Uranium	3.21 ^c	1	0.13	3.21	3.62
Vanadium	560	2.5	0.27	85.1	49.8
Zinc	5,970	1	1.1	67.8	338
Anions					

Table A-1 Analytical Results of Sampling for Nonradiological Contaminants Initiating RTD

Contaminant	Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297F7 B297H9 ZPC2 Surface (mg/kg)
Nitrate-N	40	0.75	2.1 ^d	11.8	54.9
Polynuclear Aromatic Hydrocarbons					
Acenaphthene	98	0.33	0.3	N/A	U
Acenaphthylene	98	0.33	0.3	N/A	U
Anthracene	2,270	0.33	0.3	N/A	0.35
Benzo(a)anthracene	0.86	0.33	0.3	N/A	10
Benzo(a)pyrene	0.33 ^c	0.33	0.3	N/A	6.1
Benzo(b)fluoranthene	1.37	0.33	0.3	N/A	13
Benzo(k)fluoranthene	1.37	0.33	0.3	N/A	11
Benzo(g,h,i)perylene	2,400	0.33	0.3	N/A	8.2
Chrysene	9.56	0.33	0.3	N/A	13
Dibenzo(a,h)anthracene	1.37	0.33	0.3	N/A	1.9
Fluoranthene	631	0.33	0.3	N/A	9.5
Fluorene	101	0.33	0.3	N/A	U
Indeno(1,2,3-cd)pyrene	1.37	0.33	0.3	N/A	8
Naphthalene	4.46	0.33	0.3	N/A	U
Phenanthrene	1,140	0.33	0.3	N/A	1.9
Pyrene	655	0.5	0.3	N/A	6.2
Polychlorinated Biphenyls					
Aroclor 1016	0.094	0.017	0.005	N/A	U
Aroclor 1221	0.017 ^c	0.017	0.01	N/A	U
Aroclor 1232	0.017 ^c	0.017	0.005	N/A	U
Aroclor 1242	0.039	0.017	0.005	N/A	U
Aroclor 1248	0.039	0.017	0.005	N/A	U
Aroclor 1254	0.066	0.017	0.005	N/A	U

Table A-1 Analytical Results of Sampling for Nonradiological Contaminants Initiating RTD

Contaminant	Removal Action Levels^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration^b (mg/kg)	B297F7 B297H9 ZPC2 Surface (mg/kg)
Aroclor 1260	0.5	0.017	0.005	N/A	U
Volatile Organic Analytes					
Carbon Tetrachloride	0.005	0.005	0.0002	N/A	U
Total Petroleum Hydrocarbons					
Diesel	2,000	5	30 ^d	N/A	570
Kerosene	2,000	5	30 ^d	N/A	U

a. Removal action levels are from DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit* (RAWP).

b. If Hanford Site-specific background data is not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available in nonradiological background data from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 1, Table D39-2.

c. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits per Ecology (1996), WAC 173-340-700(4)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards," and WAC 173 340 707(2), "Analytical Considerations," respectively.

d. Maximum reported laboratory method detection limits were greater than the required detection limit per the RAWP; however, analytical results are below the established removal action levels and meet the corresponding removal action objectives.

e. Manganese was not considered a contaminant of potential concern for this sample location based on process knowledge and historical information. The value obtained is consistent with recorded background values for manganese at the Hanford Site, and does not indicate a source of contamination.

N/A = not available

U = Analyzed for but not detected above laboratory method detection limit.

Table A-2. Analytical Results of In Process Sampling for Nonradiological Contaminants

Metals									
Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297K1 B297K7 ZPC6b 4 ft (mg/kg)	B297K2 B297K8 ZPC7b 4 ft (mg/kg)	B297H6 B297J8 ZPC2 8 ft (mg/kg)	B297K3 B297K9 ZPC2 11 ft (mg/kg)		
Antimony	5.4	0.31	5	U	U	U	U		
Arsenic	6.5 ^c	0.41	6.5	2.56	2.24	2.16	2.16		
Barium	1,650	0.21	132	52.7	53.8	48.3	45.9		
Beryllium	63.2	0.10	1.51	0.366	0.29	0.255	0.306		
Boron	210	2	N/A	8.79	11.9	10.1	10.9		
Cadmium	0.81 ^c	0.10	0.81	U	0.105	U	U		
Chromium Total	2,000	1	18.5	3.84	2.98	3.59	4.3		
Chromium (VI)	N/A	0.5	N/A	U	U	U	U		
Cobalt	15.7 ^c	2	15.7	9.75	11.1	11.5	10.5		
Copper	284	1	22	18.7	21.2	18.9	17.3		
Lead	250	5	10.2	4.18	5.97	4.97	3.5		
Lithium	160	2.5	33.5	3.88	2.05	2.27	3.6		
Manganese	512 ^c	5	512	319	372	387	384		
Mercury	2.09	0.2	0.33	U	U	U	U		
Nickel	130	4	19.1	8.75	7.85	8.84	9.91		
Selenium	5.2	1	0.78	1.82	2.67	2.47	2.02		
Silver	13.6	0.2	0.73	U	U	U	U		

Table A-2. Analytical Results of In Process Sampling for Nonradiological Contaminants

Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297K1	B297K2	B297H6	B297K3	
				B297K7 ZPC6b 4 ft (mg/kg)	B297K8 ZPC7b 4 ft (mg/kg)	B297J8 ZPC2 8 ft (mg/kg)	B297K9 ZPC2 11 ft (mg/kg)	
Strontium	2,920	1	0.10	N/A	25	25.4	32.1	24.9
Thallium	1.59	1	0.10	0.1	U	U	U	U
Tin	48,000	10	0.10	N/A	0.479	0.698	0.501	0.466
Uranium	3.21 ^c	1	0.10	3.21	0.484	0.569	0.55	0.44
Vanadium	560	2.5	0.21	85.1	51.7	72.9	67.5	69.4
Zinc	5,970	1	0.83	67.8	44.3	60.2	55	49.1
Anions								
Nitrate-N	40	0.75	1.70 ^d	11.8	1.6	U	7.51	8.5
Polynuclear Aromatic Hydrocarbons								
Acenaphthene	98	0.33	0.2	N/A	U	U	U	U
Acenaphthylene	98	0.33	0.2	N/A	U	U	U	U
Anthracene	2,270	0.33	0.2	N/A	U	U	U	U
Benzo(a)anthracene	0.86	0.33	0.2	N/A	U	U	U	U
Benzo(a)pyrene	0.33 ^e	0.33	0.2	N/A	U	U	U	U
Benzo(b)fluoranthene	1.37	0.33	0.2	N/A	U	U	U	U
Benzo(k)fluoranthene	1.37	0.33	0.2	N/A	U	U	U	U
Benzo(g,h,i)perylene	2,400	0.33	0.2	N/A	U	U	U	U
Chrysene	9.56	0.33	0.2	N/A	U	U	U	U

Table A-2. Analytical Results of In Process Sampling for Nonradiological Contaminants

Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297K1 B297K7 ZPC6b 4 ft (mg/kg)	B297K2 B297K8 ZPC7b 4 ft (mg/kg)	B297H6 B297J8 ZPC2 8 ft (mg/kg)	B297K3 B297K9 ZPC2 11 ft (mg/kg)
Dibenzo(a,h)anthracene	1.37	0.33	0.2	N/A	U	U	U
Fluoranthene	631	0.33	0.2	N/A	U	U	U
Fluorene	101	0.33	0.2	N/A	U	U	U
Indeno(1,2,3-cd)pyrene	1.37	0.33	0.2	N/A	U	U	U
Naphthalene	4.46	0.33	0.2	N/A	U	U	U
Phenanthrene	1,140	0.33	0.2	N/A	U	U	U
Pyrene	655	0.5	0.2	N/A	U	U	U
Polychlorinated Biphenyls							
Aroclor 1016	0.094	0.017	0.004	N/A	U	U	U
Aroclor 1221	0.017 ^c	0.017	0.009	N/A	U	U	U
Aroclor 1232	0.017 ^c	0.017	0.004	N/A	U	U	U
Aroclor 1242	0.039	0.017	0.004	N/A	U	U	U
Aroclor 1248	0.039	0.017	0.004	N/A	U	U	U
Aroclor 1254	0.066	0.017	0.004	N/A	U	U	U
Aroclor 1260	0.5	0.017	0.004	N/A	U	U	U
Volatile Organic Analytes							
Carbon Tetrachloride	0.005	0.005	0.001	N/A	U	U	U

Table A-2. Analytical Results of In Process Sampling for Nonradiological Contaminants

Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	Total Petroleum Hydrocarbons					
				B297K1 B297K7 ZPC6b 4 ft (mg/kg)	B297K2 B297K8 ZPC7b 4 ft (mg/kg)	B297H6 B297J8 ZPC2 8 ft (mg/kg)	B297K3 B297K9 ZPC2 11 ft (mg/kg)		
Diesel	2,000	4	N/A	U	U	U	U		
Kerosene	2,000	4	N/A	U	U	U	U		

a. Removal action levels are from DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit (RAWP)*.

b. If Hanford Site-specific background data is not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available in nonradiological background data from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 1, Table D39-2.

c. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits per Ecology (1996), WAC 173-340-700(4)(d), "Model Toxics Control Act—Cleanup," "Overview of Cleanup Standards," and WAC 173 340 707(2), "Analytical Considerations," respectively.

d. Maximum reported laboratory method detection limits were greater than the required detection limit per the RAWP; however, analytical results are below the established removal action levels and meet the corresponding removal action objectives.

N/A = not available
U = Analyzed for but not detected above laboratory method detection limit.

Table A-3. Verification Sampling Results for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297F5 B297H7 ZPC1a Surface (mg/kg)	B297F6 B297H8 ZPC1b Surface (mg/kg)	B297F8 B297J0 ZPC3 Surface (mg/kg)	B297F9 B297J1 ZPC4 Surface (mg/kg)	B297H0 B297J2 ZPC5 Surface (mg/kg)	B297H1 B297J3 ZPC6a Surface (mg/kg)	B297H2 B297J4 ZPC7a Surface (mg/kg)	B297H3 B297J5 ZPC8 Surface (mg/kg)	B2D793 RV-1 Surface	B2D795 RV-2 Surface
Metals														
Antimony	5.4	0.6	0.32	5	U	U	U	0.938	U	U	U	U	U	U
Arsenic	6.5 ^c	1	0.43	6.5	2.66	2.35	2.66	2.06	2.62	3.57	2.43	2.7	2.04	2.6
Barium	1,650	2	0.22	132	83.9	91.6	106	76.8	135	444	83.5	205	47.5	73.9
Beryllium	63.2	0.5	0.11	1.51	0.429	0.353	0.408	0.41	0.27	0.126	0.301	0.292	0.284	0.47
Boron	210	2	4.4 ^d	N/A	U	4.44	10.3	7.65	7.92	12.4	12.7	14.1	U	U
Cadmium	0.81 ^c	0.5	0.11	0.81	0.153	U	0.178	0.619	0.253	0.53	0.227	0.119	U	0.117
Chromium Total	2,000	1	0.54	18.5	11.9	12.6	11.8	11.1	8.68	10.7	9.42	10.4	7.68	11.9
Chromium (VI)	N/A	0.5	0.53 ^d	N/A	U	U	U	U	U	U	U	U	0.000348	U
Cobalt	15.7 ^c	2	0.11	15.7	7.9	8.12	8.33	7.15	6.46	6.03	7.48	6.92	11.8	9.93
Copper	284	1	0.11	22	11.2	12.1	16.8	12.6	14.1	18.7	14.2	14.8	17.6	15.8
Lead	250	5	0.11	10.2	4.92	4.88	7.56	35.1	12.2	40.9	14.7	8.29	3.49	5.37
Lithium	160	2.5	0.43	33.5	7.54	7.29	10.1	8.19	7.29	7.42	7.12	7.53	4.41	5.35
Manganese	512 ^c	5	11 ^d	512	379	386	384	276	315	296	335	309	NA	NA
Mercury	2.09	0.2	0.054	0.33	U	U	U	U	U	U	U	U	NA	NA
Nickel	130	4	0.22	19.1	10.1	11.1	10.7	8.93	9.06	9.09	9.89	11.3	9.32	11.4
Selenium	5.2	1	0.32	0.78	1.53	1.37	1.63	1.12	0.845	0.798	0.66	0.873	1.2	1.23
Silver	13.6	0.2	0.11	0.73	U	U	U	U	U	U	U	U	U	U
Strontium	2,920	1	0.11	N/A	23.4	24.8	37.7	66.8	51.8	135	28.6	52	26.2	31.9
Thallium	1.59	1	0.11	0.1	0.118	U	0.104	U	U	U	U	U	U	U
Tin	48,000	10	0.11	N/A	0.445	0.417	0.678	2.48	0.572	2.71	0.83	0.732	0.607	0.521
Uranium	3.21 ^c	1	0.11	3.21	0.517	0.465	0.517	0.443	0.504	1.54	0.863	0.467	0.479	0.575
Vanadium	560	2.5	0.22	85.1	48.6	51.1	51.7	39.2	32.4	30.4	39.4	42.6	94.1	70.1
Zinc	5,970	1	0.87	67.8	43.3	45.2	56.2	427	83.4	437	63.8	47.6	57.8	52.5
Anions														
Nitrate-N	40	0.75	1.70 ^d	11.8	U	U	1.61	3	4.72	3.21	U	1.73	NA	NA

Table A-3. Verification Sampling Results for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297F5 B297H7 ZPC1a Surface (mg/kg)	B297F6 B297H8 ZPC1b Surface (mg/kg)	B297F8 B297J0 ZPC3 Surface (mg/kg)	B297F9 B297J1 ZPC4 Surface (mg/kg)	B297H0 B297J2 ZPC5 Surface (mg/kg)	B297H1 B297J3 ZPC6a Surface (mg/kg)	B297H2 B297J4 ZPC7a Surface (mg/kg)	B297H3 B297J5 ZPC8 Surface (mg/kg)	B2D793 RV-1 Surface	B2D795 RV-2 Surface
Polynuclear Aromatic Hydrocarbons														
Acenaphthene	98	0.33	0.2	N/A	U	U	U	U	U	U	U	U	U	U
Acenaphthylene	98	0.33	0.2	N/A	U	U	U	U	U	U	U	U	U	U
Anthracene	2,270	0.33	0.2	N/A	U	U	U	U	U	U	U	U	U	U
Benzo(a)anthracene	0.86	0.33	0.2	N/A	U	U	0.33	0.46	U	U	U	0.23	U	U
Benzo(a)pyrene	0.33 ^c	0.33	0.2	N/A	U	U	U	0.25	U	U	U	U	U	U
Benzo(b)fluoranthene	1.37	0.33	0.2	N/A	U	U	0.47	0.63	U	U	U	0.28	U	U
Benzo(k)fluoranthene	1.37	0.33	0.2	N/A	U	U	0.41	0.52	U	U	U	0.25	U	U
Benzo(g,h,i)perylene	2,400	0.33	0.2	N/A	U	U	U	U	U	U	U	U	U	U
Chrysene	9.56	0.33	0.2	N/A	U	U	0.41	0.6	U	U	U	0.28	U	U
Dibenzo(a,h)anthracene	1.37	0.33	0.2	N/A	U	U	U	U	U	U	U	U	U	U
Fluoranthene	631	0.33	0.2	N/A	U	U	U	0.35	0.27	U	U	0.22	U	U
Fluorene	101	0.33	0.2	N/A	U	U	U	U	U	U	U	U	U	U
Indeno(1,2,3-cd)pyrene	1.37	0.33	0.2	N/A	U	U	0.23	0.23	U	U	U	U	U	U
Naphthalene	4.46	0.33	0.2	N/A	U	U	U	U	0.22	U	U	U	U	U
Phenanthrene	1,140	0.33	0.2	N/A	U	U	U	U	0.42	U	U	U	U	U
Pyrene	655	0.5	0.2	N/A	U	U	U	0.26	U	U	U	U	U	U
Polychlorinated Biphenyls	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Aroclor 1016	0.094	0.017	0.004	N/A	U	U	U	U	U	U	U	U	NA	NA
Aroclor 1221	0.017 ^c	0.017	0.009	N/A	U	U	U	U	U	U	U	U	NA	NA
Aroclor 1232	0.017 ^c	0.017	0.004	N/A	U	U	U	U	U	U	U	U	NA	NA
Aroclor 1242	0.039	0.017	0.004	N/A	U	U	U	U	U	U	U	U	NA	NA
Aroclor 1248	0.039	0.017	0.004	N/A	U	U	U	U	U	U	U	U	NA	NA
Aroclor 1254	0.066	0.017	0.004	N/A	U	U	U	U	U	U	U	U	NA	NA
Aroclor 1260	0.5	0.017	0.004	N/A	U	U	U	U	U	U	U	U	NA	NA

Table A-3. Verification Sampling Results for Nonradiological Contaminants of Potential Concern

Contaminant of Potential Concern	Removal Action Levels ^a (mg/kg)	Required Detection Limit (mg/kg)	Maximum Reported Laboratory Method Detection Limit (mg/kg)	Background Concentration ^b (mg/kg)	B297F5 B297H7 ZPC1a Surface (mg/kg)	B297F6 B297H8 ZPC1b Surface (mg/kg)	B297F8 B297J0 ZPC3 Surface (mg/kg)	B297F9 B297J1 ZPC4 Surface (mg/kg)	B297H0 B297J2 ZPC5 Surface (mg/kg)	B297H1 B297J3 ZPC6a Surface (mg/kg)	B297H2 B297J4 ZPC7a Surface (mg/kg)	B297H3 B297J5 ZPC8 Surface (mg/kg)	B2D793 RV-1 Surface (mg/kg)	B2D795 RV-2 Surface (mg/kg)
Volatile Organic Analytes	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Carbon Tetrachloride	0.005	0.005	0.003	N/A	U	U	U	U	U	U	U	U	NA	NA
Total Petroleum Hydrocarbons	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Diesel	2,000	5	8 ^d	N/A	26	29	22	56	48	59	23	51	NA	NA
Kerosene	2,000	5	8 ^d	N/A	U	U	U	U	U	U	U	U	NA	NA

a. Removal action levels are from DOE/RL-2009-53, *Removal Action Work Plan for 48 Waste Sites in the 200-MG-1 Operable Unit* (RAWP).

b. If Hanford Site-specific background data is not available, values are then taken from Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. Hanford Site background values are available in nonradiological background data from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 1, Table D39-2.

c. Where cleanup levels are less than background or required detection limits, cleanup levels default to background or required detection limits per Ecology (1996), WAC 173-340-700(4)(d), “Model Toxics Control Act—Cleanup,” “Overview of Cleanup Standards,” and WAC 173 340 707(2), “Analytical Considerations,” respectively.

d. Maximum reported laboratory method detection limits were greater than the required detection limit per the RAWP; however, analytical results are below the established removal action levels and meet the corresponding removal action objectives.

N/A = not available

NA = not applicable

U = Analyzed for but not detected above laboratory method detection limit.